

## PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

12 OCT 2004

PCT

To:

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13 JUL 2004	
PARTNER	ACTIONED

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT  
(PCT Rule 71.1)

Date of mailing  
(day/month/year) 09.07.2004

Applicant's or agent's file reference  
NOTBP28303PC

## IMPORTANT NOTIFICATION

International application No.  
PCT/GB 03/01633

International filing date (day/month/year)  
15.04.2003

Priority date (day/month/year)  
15.04.2002

Applicant  
THE UNIVERSITY OF NOTTINGHAM et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

## 4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international  
preliminary examining authority:



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INTERNATIONAL PRELIMINARY EXAMINATION REPORT  
(PCT Article 36 and Rule 70)



12 OCT 2004

Applicant's or agent's file reference NOTB/P28303PC	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 03/01633	International filing date (day/month/year) 15.04.2003	Priority date (day/month/year) 15.04.2002
International Patent Classification (IPC) or both national classification and IPC H02M5/293		
Applicant THE UNIVERSITY OF NOTTINGHAM et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 8 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
- These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  07.11.2003	Date of completion of this report  09.07.2004
Name and mailing address of the International preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Kampka, A  Telephone No. +49 89 2399-2244  

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/GB 03/01633**

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-23 as originally filed

**Claims, Numbers**

1-18 filed with telefax on 21.05.2004

**Drawings, Sheets**

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search, (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination, (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☒ the claims, Nos.: 19-22
- ☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).  
*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 15-18

because:

☒ the said international application, or the said claims Nos. 15-18 relate to the following subject matter which does not require an international preliminary examination (specify):

**see separate sheet**

☐ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. are so unclear that no meaningful opinion could be formed *(specify)*:

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos.

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the Standard.

☐ the computer readable form has not been furnished or does not comply with the Standard.

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-7
	No: Claims	8
Inventive step (IS)	Yes: Claims	1-7
	No: Claims	8
Industrial applicability (IA)	Yes: Claims	1-14
	No: Claims	

2. Citations and explanations

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see separate sheet

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**Re Item III**

**Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

Claims 15 - 18 relate to software, a carrier for software and electronic distribution of software, i.e. to claimed subject-matter under Rule 67.1 PCT, which will not be the subject of an international preliminary examination (Art. 34(4)(a)(i)(ii) PCT).

**Re Item V**

**Reasoned statement under Art. 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Reference is made to the following documents:

- D1: US-A-5 214 366 (ROLF HOLLMANN) 25 May 1993 (1993-05-25)
- D2: PATENT ABSTRACTS OF JAPAN vol. 1995, no. 11, 26 December 1995 (1995-12-26) & JP 07 213062 A (NIPPON ELECTRIC IND.), 11 August 1995 (1995-08-11)
- D3: US-A-4 713 743 (ALBERTO ABBONDANTI) 15 December 1987 (1987-12-15)
- D4: US-A-5 852 559 (HSIN-HUA) 22 December 1998 (1998-12-22)
- D5: PATENT ABSTRACTS OF JAPAN vol. 1997, no. 03, 31 March 1997 (1997-03-31) & JP 08 289564 A (NIPPON ELECTRIC IND.), 1 November 1996 (1996-11-01)
- D6: US-A-5 594 636 (COLIN D. SCHAUDER) 14 January 1997 (1997-01-14)
- D7: US-A-5 892 677 (JIE CHANG) 6 April 1999 (1999-04-06)
- D8: DE 197 46 797 A (TU CHEMNITZ) 6 May 1999 (1999-05-06)
- D9: M. ZIEGLER: 'Implementation of a two steps commutated matrix converter.' IEEE, 1999, pages 175-180, XP010346891

D6 and D7 are cited in the application on page 1.

1. The present application does not satisfy the criterion set forth in Art. 33(2) PCT because the subject-matter of independent claim 8 is not new.

Document D1 discloses (see claim 2, column 2, lines 64 - 67 and Fig. 1) all the features of independent claim 8.

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The applicant argues that D1 concerns a cycloconverter, whereas the present invention concerns a matrix converter. However, claim 8 is directed to a method of operating a converter having a plurality of bi-directional switch means arranged in a configuration. It appears that also the cycloconverter of D1 has a plurality of bi-directional switch means arranged in a configuration. The method step of claim 1, i.e. comprising effective current commutation to operate the switch means to begin activation of one switch means before de-activation of another switch means appears to be disclosed in D1. The feature "wherein a commutation interval approaches or equals zero" cannot contribute to novelty or an inventive step, because the term "approaching zero" is not precise so that also D1 could be interpreted in this sense. The argumentation concerning switching frequency has not convinced the examiner, because the switching frequency is not defined in independent claim 8.

The applicant is informed that in the examination practice of the European Patent Office facultative features which only belong to certain embodiments defined in dependent claims and/or the description, cannot support the necessary inventive activity for the subject-matter of the independent claims. In other words: a feature, which is not defined in independent claim 1, cannot establish an inventive step for the subject-matter of claim 1. Furthermore, any independent claim must contain all essential features of the invention. A feature, which is only defined in one of the independent claims, e.g. in claim 1, cannot establish an inventive step for another independent claim, e.g. claim 8.

2. The present application does not satisfy the criterion set forth in Art. 33(3) PCT because the subject-matter of independent claim 8 does not involve an inventive step.

The subject-matter of independent claim 8 does not involve an inventive step, because the necessary condition of novelty is not met (see the above comments).

3. Claim 1 is directed to a matrix converter. Documents D2 and D6 relate to matrix converters. D6, which is cited in the description on page 1 is considered to represent the closest prior art.

Starting from D6 the problem is to reduce or limit the overlap period.

According to claim 1, the object is starting from D6 solved by introduction of

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means to provide a commutation interval which approaches or equals zero.

Starting from D6, the solution of claim 1 does not appear obvious by considering the teaching of D2, because each of these documents accepts the necessity that there is a substantial overlap. Neither D2, nor D6 considers or envisages the possibility of seeking to reduce or limit the overlap.

Starting from the matrix converter of D6 a combination with commutation features of D1 and D3-D5 relating to cyclo-converters does not appear obvious, either, because the current commutation of a matrix converter is very different to the cyclo-converter.

4. There are no objections concerning industrial applicability of claims 1 - 14.

5. Therefore, claim 1 meets the criteria set forth in Art. 33(1) PCT with respect to the available prior art. Claims 2 - 7 relate to preferred embodiments and therefore also meet these criteria.

6. From the above discussion it is clear that the examiner is of the opinion that claims 8 - 14 would meet the criteria set forth in Art. 33(1) PCT with respect to the available prior art, if independent claim 8 would be limited to a method of operating a matrix converter.

**Additional remarks:**

The independent claims should have been drafted in the two-part form, whereby all the features known from D6 should have been placed in the preamble (Rule 6.3(b) PCT). If, however, the applicant is of the opinion that the two-part form would be inappropriate, then the applicant should have ensured that it is clear from the description which features of the subject-matter of the independent claims are already known in combination from the closest prior art (see the PCT Guidelines, III-2.3a).

The features of preamble and characterizing part of all the claims should have been provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

The definition of the invention in the description should have been adapted to the new independent claims. The present "summary of the invention" on page 1, third



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paragraph - page 4, second paragraph could be replaced by the brief statement:  
"The invention is defined by the features of the independent claims. Preferred  
embodiments are defined in the dependent claims." Alternatively, the wording of  
the claims could be repeated in the description as "summary of the invention".  
Different definition of the inventions in the claims and the description, however,  
should be avoided, because such inconsistencies could lead to unclarity if the  
claims are read together with the description, Art. 6 PCT.

**CLAIMS**

1. A matrix converter having a plurality of bi-directional switch means arranged in a configuration, the converter comprising current commutation means to effect operation of the switch means to begin initiation of one switch means before de-activation of another switch means wherein the operating means comprises means to provide a commutation interval which approaches or equals zero.
2. A converter according to Claim 1 comprising a first switch means and a second switch means whereby, in a first mode in use, the first switch means is activated and the second switch means is not activated, and the current commutation means is operable to activate the second switch means before the first switch means is de-activated.
3. A converter according to any preceding claim wherein the operating means comprises means to minimise the commutation interval.
4. A converter according to any preceding claim wherein the operating means comprises means to provide a commutation interval of less than those typically used as the deadtime in a Voltage Source Inverter.
5. A converter according to any preceding claim wherein the operating means comprises means to provide a commutation interval which is negative.
6. A converter according to any preceding claim wherein the operating means comprises means to provide a commutation interval which is negative up to the total turn-off delays and times of the switching devices used for the converter realisation.

7. A converter according to any preceding claim wherein the converter comprises a plurality of switches and timers thereby to effect reduction of the commutation interval.

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8. A method of operating a converter having a plurality of bi-directional switch means arranged in a configuration, the method comprising effecting current commutation to operate the switching means to begin activation of one switch means before de-activation of another  
10 switch means wherein a commutation interval approaches or equals zero.

9. A method according to Claim 8 comprising operating the current commutation means in order to activate a second switch means before a first switch means is de-activated.

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10. A method according to Claim 8 or 9 comprising minimising the commutation interval.

11. A method according to any of Claims 8 to 10 comprising providing  
20 commutation interval of less than those typically used as the deadtime in a Voltage Source Inverter.

12. A method according to any of Claims 8 to 11 comprising providing a commutation interval which is negative.

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13. A method according to any of Claims 8 to 12 comprising a commutation interval which is negative up to the total turn-off delays and times of the switching devices used for the converter realisation.

14. A method according to any of Claims 8 to 13 comprising operating a plurality of switches and timers thereby to effect reduction of the commutation interval.
- 5 15. A computer program product directly loadable into the internal memory of a digital computer, comprising software code portions for performing the steps of any one of Claims 8 to 14 when said product is run on a computer.
- 10 16. A computer program directly loadable into the internal memory of a digital computer, comprising software code portions for performing the steps of any one of Claims 8 to 14 when said program is run on a computer.
- 15 17. A carrier, which may comprise electronic signals, for a computer program of Claim 16.
18. Electronic distribution of a computer program product of Claim 15 or a computer program of Claim 16 or a carrier of Claim 17.

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